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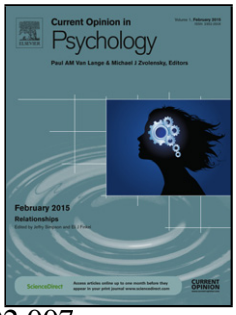

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Prenatal Parenting

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Prenatal parenting

Highlights

● parenting begins before birth

●the mother's emotional state, including her stress, anxiety and depression, during pregnancy can alter the development of her fetus and her child

● we are starting to understand the biological mechanisms which may underlie such fetal programming, including the role of the placenta

●bonding between both mother and father and child can start before birth.

●we need to intervene during pregnancy to support vulnerable mothers

Abstract

Parenting begins before birth. This includes prenatal maternal and paternal bonding with the baby, and biological effects on fetal development. Recent research has confirmed how prenatal maternal stress can alter the development of the fetus and the child, and that this can persist until early adulthood. Children are affected in different ways depending, in part, on their own genetic makeup. The fetus may also have a direct effect on prenatal maternal mood and later parenting behaviour via the placenta. The father is important prenatally too. An abusive partner can increase the mother's prenatal stress and alter fetal development, but he can also be an important source of emotional support. New research suggests the potential benefits of prenatal interventions, including viewing of prenatal scans and cognitive behavioural therapy.

Introduction

Parents can alter the development of their child, even before birth. Several different ways in which this can occur will be discussed in this review. The mother's emotional state during pregnancy can have a direct influence on fetal development by fetal programming. Her obesity can also alter the development of her fetus and child. The mother's emotional state during pregnancy is a predictor of her mood postnatally, so if she is depressed prenatally she is at strong risk of being depressed postnatally, and this can also have an effect on her parenting. The partner has a major part to play during pregnancy, especially by his or her effects on the mother's emotional state. An abusive partner can be very detrimental to a woman's prenatal emotional state, whereas a supportive partner may buffer her against depression or anxiety. The feelings of bonding or attachment between a parent and baby can start prenatally, and continue after the baby is born. Again this is mostly observed between the mother and her unborn child, but the father can start to have feelings of attachment prenatally. It is well known that maternal smoking, alcohol and drug consumption during pregnancy can affect fetal development. However, evidence from animal studies suggests that paternal alcohol consumption may also have an effect on the offspring, reducing cognitive development, and increasing anxiety and depression, via epigenetic changes in the sperm (Liang et al., 2014). Most of the research on these topics has been psychological, but the underlying biology is starting to be explored, as are interventions that start in pregnancy and can help child outcome.

Maternal mood in pregnancy

Women have as many symptoms of depression and anxiety during pregnancy as they do postnatally (Heron et al., 2004). These can have a direct effect on the

development of her baby (see fetal programming below), as can other experiences of stress, including exposure to natural disasters (King et al., 2012) such as an ice storm in Canada (Laplante et al., 2008), or to man-made traumas, such as 9/11 (Yehuda et al., 2005). Many women have pregnancy specific anxiety, an especial concern about the outcome of their pregnancy, and some recent studies have found that this is especially predictive of alterations in the child (e.g., Hompes et al. (2013)). Many women who are depressed in pregnancy have been subjected to early trauma themselves, with evidence to suggest that early trauma predicts prenatal rather than postnatal depression (Robertson-Blackmore et al., 2013). This history can be especially important with respect to child psychological outcome (Plant et al., 2013). Blakemore et al. have also found that childhood trauma exposure increased the risk for low birthweight associated with prenatal mood disturbance (Blakemore and Mills, 2014). It is not clear why such early trauma in the pregnant mother exacerbates the effects of her mood on fetal development and growth, but pregnancy is a time when she may be more aware of her own parenting or care as discussed by Fraiberg et al., (1975) in "The ghosts in the nursery", and more recent studies on intergenerational transmission suggest possible biological mechanisms also (Moog et al., 2016).

Fetal programming

Fetal programming is the concept that the environment in the womb, during different sensitive periods for specific outcomes, can alter the development of the fetus, with a long lasting effect on the child (Barker, 1990). If the mother is stressed, anxious or depressed whilst she is pregnant, this can have a direct effect on the development of her fetus (Glover, 2015). The child is somewhat more likely to be born smaller for gestational age, and also to be born earlier. But most of the effects that have been

documented are on neurodevelopment outcomes, with altered emotional, behavioural and cognitive processing, including increased risk of symptoms of anxiety and depression, attention deficit hyperactivity disorder (ADHD) and conduct disorder. The effects have been shown to last at least until early adulthood (Capron et al., 2015, Pearson et al., 2013). It is not only extreme or toxic stress that is detrimental, or a diagnosed mental illness, but increased levels of daily hassles (Huizink et al., 2003) or milder symptoms of anxiety or depression may also be important.

A UK cohort study (ALSPAC Study) has shown that if a pregnant mother was in the top 15% for symptoms of anxiety or depression, her child had double the risk for a probable mental disorder at age 13 years (O'Donnell et al., 2014a). The risk increased from about 6% to about 12%. This study allowed for a wide range of possible confounders, including postnatal maternal mood, parenting, paternal mood, and socioeconomic status, thus showing that there were prenatal effects independent of postnatal and other factors that also contribute to child outcome. Most children were not affected, and those that were, were affected in different ways. These different outcomes probably depend both on the genetic vulnerabilities of each child (O'Donnell et al., 2014b), and on the nature of the postnatal care.

The term fetal programming does not imply that these changes during the in utero period are irreversible. Indeed, we know that they are not. For example, sensitive mothering in the early postnatal period can prevent some of the cognitive effects of in utero exposure to cortisol ((Bergman et al., 2010) (see section on underlying biology below). The brain continues to develop throughout gestation, and long afterwards, and it can continue to be modified, but it is very plastic, and subject to alteration at the beginning.

Prenatal attachment or bonding

There is good evidence that a mother can start to bond with her baby while she is pregnant and that this can continue into her relationship with her baby after birth. For example Rossen et al., (2016) have shown that higher prenatal bonding predicted higher postnatal bonding, and that maternal depressive symptoms in trimesters two and three were related to poorer mother-infant bonding 8 weeks postnatally. Mazzeschi et al.,(2015) have also shown that the maternal attitude to the baby during pregnancy was correlated with adjustment to the baby and parenting stress postnatally. Women who are depressed during pregnancy are generally less likely to form strong prenatal bonds with their unborn baby (Goecke et al., 2012). It is also interesting that a mother's mood during pregnancy (Pearson et al., 2012b) and also her alcohol consumption (Pearson et al., 2012a) are related to her sensitivity to her infant postnatally, independently of her postnatal mood. Fathers also start to bond with their baby prenatally and the pattern of bonding remains stable from pregnancy until toddlerhood (de Cock et al 2016).

Obesity

Maternal obesity is also associated with altered outcome for her child. High pre pregnancy BMI has been shown to increase the risk of her child having symptoms of ADHD and emotional difficulties (Rodriguez, 2010). Additionally, de Vries et al., (2014) found that high pre pregnancy BMI increased the risk of the baby developing a wheeze. Both maternal and paternal pre pregnancy obesity have been found to be associated with an altered epigenetic pattern in the baby's cord blood (Soubry et al., 2015), although this type of study requires replication.

Fathers

The partner is very important in relation to the mother's feelings of stress, and this can affect the development of her fetus. Mothers who said that their partner was emotionally cruel to them had children more likely to score less well cognitively, and to show more fear reactivity, even when a range of other potential confounders, including postnatal experience, were taken into account (Bergman et al., 2007). The mood of the father during pregnancy is important also. Mothers with prenatally depressed partners showed significant worsening in overall symptom severity during the first six postnatal months (Paulson et al., 2016), and Liu et al., (2012) showed that new paternal prenatal depression was associated with very preterm birth, possibly mediated by the effect on the mother's emotional state.

Underlying biology

The biological mechanisms that underlie fetal programming, and possibly some of the other aspects of prenatal parenting such as prenatal bonding, are only just starting to be understood. We do not know what changes in the mother are most important for mediating the effects of her prenatal mood on fetal development. Her cortisol can increase in association with depression, but less than outside pregnancy, especially as gestation increases and the placenta secretes high levels of cortisol in all women (O'Donnell et al., 2009). Pro inflammatory cytokines may well be important mediators (Glover, 2015). Prenatal plasma TNF-α levels have been found to be raised in women who have experienced early trauma (Blackmore et al., 2011). There is increasing research showing that the function of the placenta changes in response to maternal mood, and can alter its filtering capacity, especially to cortisol (Glover, 2015). A down regulation of the placental enzyme that

metabolises cortisol has been found to be associated with raised maternal symptoms of anxiety (O'Donnell et al., 2012). There is also evidence that increased in utero exposure to cortisol is associated with altered fetal growth (Hompes et al., 2012) and infant cognitive development (Bergman et al., 2010). However, the direction of influence is not all one way. The fetal genome regulates maternal physiology and behaviour via the placenta too (Broad and Keverne, 2011). The placenta produces hormones that act on the maternal hypothalamus, and can alter later mothering behaviour (Janssen et al 2016). The peptide PEG3 is of especial interest with regards to this. It has been shown to be important in nest building and nurturing behaviour in rodents (Champagne and Curley, 2009). We have recently shown in three independent cohorts that prenatal maternal depression is associated with a down regulation of placental PEG3 expression (Janssen et al., 2016). It is of interest in this regard that it has been found that women with high depressive symptom scores during mid pregnancy, but not when their infants were 8 months, had a 30% increased risk of low maternal responsiveness when the infant was 12 months compared to women with consistently low depression (Pearson et al., 2012b). It would be of interest to test in the future whether maternal prenatal PEG3 levels mediate the relation between prenatal stress or depression, and postnatal mothering and child development. The role of the bonding hormone oxytocin is also being explored. Eapen et al., (2014) found an association between maternal symptoms of separation anxiety and depression during pregnancy and lower oxytocin level in the postnatal period.

Interventions

All this suggests that interventions with the parents to improve child outcome should start before birth. Both Pavlova et al., (2015) and de Jong-Pleij et al., (2013) have

shown that viewing ultrasound scans had a positive impact on prenatal maternal-fetal bonding. Rather few interventions have started during pregnancy and followed the outcome for the child, but those that do show promise. The most studied is the Nurse Family Partnership in the USA (Olds et al., 2004) and is targeted at lower income teenage mothers. This manualised program starts in pregnancy with visits from specially trained nurses and continues for the next two years. The nurses give considerable social support but also teach aspects of parenting, as well as helping with other things such as diet. The children have been followed up into early adulthood and show remarkable improvement in a variety of ways (e.g Enoch et 2016). However an attempted replication in England, which has followed the children until two years old has shown little benefit (Robling et al., 2016). It is not clear whether this is because the early outcomes studied were not the most appropriate, or whether the increased support available in the UK from midwives and health visitors makes the program less necessary. The subjects may also have been less deprived in the UK sample. A pilot study from Australia with cognitive behavioural therapy for depressed pregnant women has shown promising outcomes with improvements for problem solving, self-regulation and stress reactivity in the babies at 9 months, independent of maternal postnatal mood (Milgrom et al., 2015).

Conclusion

Parenting begins before birth. The emotional state of the pregnant woman can affect her child by fetal programming, by prenatal bonding, and via links with her postnatal mood and parenting. The father is an important determinant of the mother's emotional state too. For the best outcomes for our children we need to start to

provide appropriate help to both parents prenatally, especially for those who are most vulnerable.

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Legend to Figure 1.

Prenatal parenting. Potential pathways through which both mother and father may affect child outcome before birth

Figure 1.